

What is claimed is:

1. A method for nondestructive inspection of grain-boundary attack due to thermal sensitization in a chromium-containing nickel-based alloy, comprising:

5 measuring a saturation magnetization $M_s(T_i)$ of a test piece at each of a plurality of measuring temperatures defined by equally dividing a given measuring temperature range in the range of a minimum to a maximum of Curie temperatures corresponding to respective chromium concentrations in a chromium impoverished region of said alloy; and

calculating v_k according to the following formula (1) to quantitatively determine the
10 volume of the chromium impoverished region in a divided manner on the basis of the chromium concentrations:

$$M_s(T_i) = \sum_{k=1}^i \frac{v_k M_k(T_i)}{V} \quad (1)$$

, wherein: v_k is the volume of the chromium impoverished region having a chromium concentration C_k ;

15 V is the volume of said test piece;

k is a natural number to be determined in conjunction with dividing the range of a minimum measuring temperature T_{\min} to a maximum measuring temperature T_{\max} , into n equal parts, in conformity to measurement conditions; and

$M_k(T_i)$ is a saturation magnetization at a measuring temperature T_i in the chromium
20 impoverished region having the chromium concentration C_k , said saturation magnetization being obtained in advance based on the following data (a), (b) and (c):

(a) the relationship between saturation magnetization and chromium concentration at an absolute temperature of 0 (zero) K in the chromium impoverished region;

(b) the relationship between Curie temperature and chromium concentration in
25 the chromium impoverished region; and

(c) the relationship between saturation magnetization and measuring temperature in the chromium impoverished region.

2. An apparatus for detecting magnetic characteristics of the test piece for use in the method as defined in claim 1, comprising:

a cooling-medium tank for containing a cooling medium;

a test-piece housing disposed at the central region of said cooling-medium tank to

5 receive said test piece therein;

an exciting device mounted on the inner wall of said test-piece housing to excite said test piece;

a support member for supporting said test piece in such a manner that it is located at the center position of said exciting device;

10 a magnetic flux detector disposed around said test piece;

a cooling device for supplying a cooling medium to said cooling-medium tank to circulatingly cool said test piece while allowing cooling gas generated from said cooling medium to flow into said test-piece housing;

a heating device disposed below said test piece to heat said test piece; and

15 means for controlling the measuring temperature of said test piece through the use of said cooling medium and said heating device.

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